Chemical Growth Retardation of *Baphia nitida* with PP333

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Abstract

PP333 (common name paclobutrazol), [(2RS, 3RS)-1- (4-chlorophenyl)-4, 4-dimethyl-2-(1,2,4-triazol-1-yl-) pentan-3-o1)] was tested on *Baphia nitida* hedges to evaluate its effects on growth. Results show that growth of *B. nitida* was retarded without phytotoxicity symptoms at the rates of PP333 applied. Growth retardation of up to six months was achievable at the PP333 rates tested, making chemical growth control a useful tool for the maintenance of such hedges at reduced manual pruning and related labour costs.

Introduction

PP333 is a broad spectrum growth retardant which acts by inhibiting gibberellin biosynthesis and reducing cell division and extension (Lever et al. 1982; Sugavanam 1984). It is xylem mobile and its effects include overall stunting of the plant, with shorter internodes and darker green leaves (Sugavanam 1984); it also has good fungicidal activity.

PP333 has been used on a variety of crops including graminaceous crops like wheat, barley and rye (Froggatt et al. 1982) in stem shortening properties to reduce lodging, and in fruit trees to reduce pruning requirements. In apples, growth retardation became apparent about 1½ months after treatment and shoot growth of treated plants was about 48% that of the untreated (Lever et al. 1982). Ornamental greenhouse crops like *Begonia*, *Chrysanthemum*, *Hibiscus*, *Coleus* etc were dwarfed by PP333 without any phytotoxicity symptoms (Shanks 1980).

Baphia nitida is widely planted in Singapore, being used for screening purposes. Much labour is expended in manual pruning to maintain the desired height and lateral spread of the hedges. This paper reports a study conducted in the Singapore Botanic Gardens into the use of chemical growth retardation to control the vegetative growth of *B. nitida* with the aim of reducing the frequency of manual pruning.

Materials and Methods

PP333 was tested at rates of 0 g (Control), 0.5 g, 1.0 g, and 2.0 g active ingredient per plant. A randomised complete block design consisting of three blocks was used. Each block contained four plots which were four stretches of established hedge, each about 10 m long and containing 30 plants. Plots within each block were spaced 2 m apart. The treatments were randomly assigned to the four plots in each block.

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The retardant was applied as a soil drench. A shallow trench, 3–5 cm deep, was dug around the base of each plant. PP333 at its desired rate, diluted in water, was poured into the trench which was then refilled with soil. Each plant received 150 ml of solution.

Only one application of retardant was carried out. The hedges were then left to grow and were pruned at regular intervals by the Singapore Botanic Gardens maintenance workers regularly deployed for hedge pruning operations. Pruned foliage were collected for dry weight determination. This was measured after the plant materials were dried at 100°C until constant weight.

Results and Discussion

Pruning of *B. nitida* hedges was carried out 1, 3, 6 and 9 months after application of retardant. Dry weights of foliage pruned from all plots in the three blocks are shown in Table 1. As seen in Table 2 and Figure 1 there was no significant difference between all treatment means at the first pruning one month after PP333 treatment.

Table 1

Sequence of pruning	No. of months after PP333 application	Dry weight, kg											
		Block 1				Block 2				Block 3			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
1st	1	7.1	6.9	6.7	6.8	5.2	5.0	5.4	5.4	7.9	7.8	7.9	8.5
2nd	3	0.8	1.0	1.3	7.0	0.6	0.6	0.8	5.6	1.4	1.3	1.4	7.9
3rd	6	1.5	1.7	1.4	7.6	0.6	0.6	0.5	5.6	1.5	1.6	1.7	8.0
4th	9	5.3	5.3	5.5	7.6	3.8	4.0	4.7	6.2	5.6	5.8	5.7	7.9

The trial started with the application of PP333 as a soil drench. Blocks 1, 2 and 3 were hedges in three different lawns at the Botanic Gardens. T1, T2, T3 and T4 refer to treatments of 0.5g, 1.0g, 2.0g and 0g (Control) active ingredient per plant respectively. Pruning of hedges was carried out 1, 3, 6 and 9 months after the trial started. Foliar material from individual plots were collected at each pruning for dry weight determination.

Table 2

Sequence of pruning	No. of months after PP333 application	Paclobutrazol, g/plant			
		0.5	1.0	2.0	0.0 (Control)
1st	1	6.73a	6.57a	6.67a	6.90a
2nd	3	0.93a	0.97a	1.17a	6.83b
3rd	6	1.19a	1.31a	1.20a	7.07b
4th	9	4.90a	5.03a	5.30a	7.20b

Dry weight readings in the 3 blocks/replicates were averaged. Going across the table, readings (at each pruning) with the same alphabet are not significantly different at the 1% level.

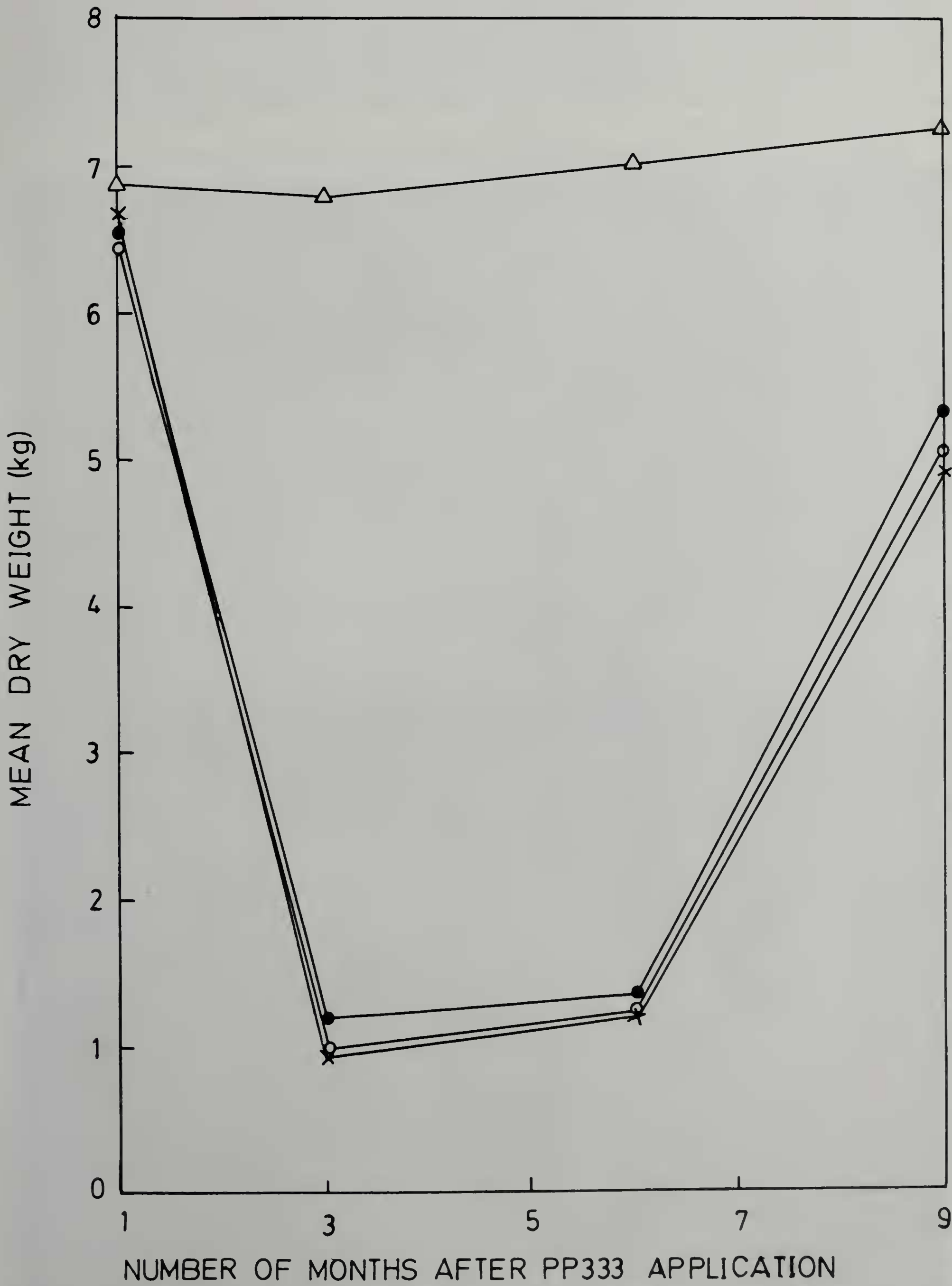

Fig. 1. Mean dry weight of foliage pruned during the duration of the trial; × - 0.5 g PP333/plant, ○ - 1.0 g PP333/plant, ● - 2.0 g PP333/plant, Δ - control.

In the second pruning though, three months after PP333 treatment, a sharp and significant decrease in dry weights of foliage pruned from retardant-treated plots was observed. Growth retardation was equally effective at all three rates of PP333 tested. Subsequent prunings also yielded dry weight readings which were not significantly different for all three PP333 rates but were significantly different from the control readings. Visually a clear difference was seen between plant growth in control and treated plots (Figure 2).

Plants treated with retardant began to show signs of breaking out of retardation six months after the start of the trial. Although still compact in growth compared to the control plants, new actively growing shoots began to be produced. An increase in dry weight readings of foliage pruned from PP333 treated plots was found nine months after the start of the trial (Table 2 and Figure 1). Again the dry weights of foliage pruned from retardant-treated plots were not significantly different at all three PP333 rates but were significantly different from control readings. Nevertheless even the retardant-treated plots were growing considerably at this stage and were losing their compact and neat appearance.

Statistically the results show that all three rates of PP333 tested were equally effective in retarding *B. nitida* growth. However, visually it was seen that the higher rates of 1.0 and 2.0 g active ingredient per plant maintained a more compact and neater appearance of the plants for a longer period. To reduce chemical costs, the lower rate of 0.5 g per plant, found to effectively control growth for up to about six months, should be favoured.

To demonstrate the practicability of the 0.5 g per plant application rate, a 100 m long stretch of *B. nitida* hedge consisting of 300 plants was treated with this rate of

Fig. 2. Differences in vegetative growth of retardant-treated and control plants. The length of hedge on the right was given 0 g PP333/plant (control) while that on the left was given 0.5 g PP333/plant. The picture was taken just before the second pruning, 3 months after the start of the trial.

PP333. The plants were pruned one month after retardant application and no further pruning was subsequently done. Retardant application at the same rate was repeated six months after the initial application. Figure 3 shows the condition of the hedge one year after the trial began. The plants were compact in growth, had shorter internodes, darker green leaves and required a light pruning at most to restore uniform height for the hedge.

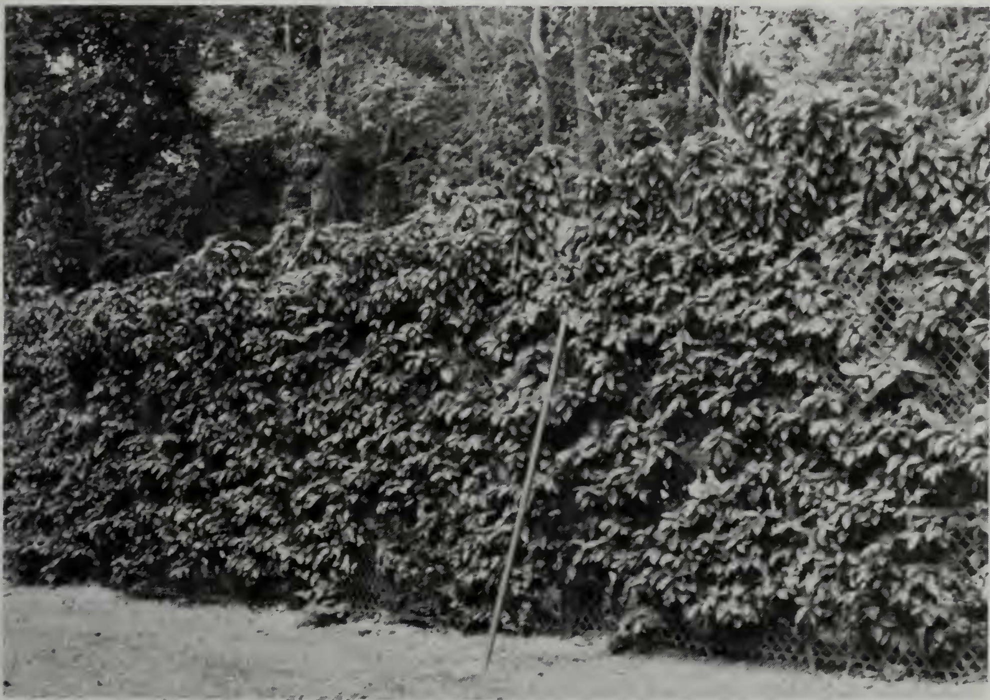

Fig. 3. PP333-treated hedge one year after retardant application. The hedges were treated with 0.5 g PP333/plant applied as a soil drench; application was repeated six months after the start of the trial. Except for one pruning one month after the first retardant application, no other pruning was done.

No phytotoxicity symptoms were encountered throughout the trial following retardant treatment. Application by soil drench was chosen because a preliminary trial showed that it effected greater retardation than foliar spray. McDaniel (1983), and Barrett and Bartuska (1982) also reported that soil drench was more effective than leaf application for *Chrysanthemum* and *Phaseolus*. It appears that the reduced effectiveness of PP333 applied to mature leaves suggests that it is less effectively translocated through the phloem compared to the xylem.

Conclusion

The results reported here show that chemical growth retardation of PP333 is an effective tool for reducing the need for manual pruning of *B. nitida* hedges. This is expected to make maintenance of such hedges less manpower intensive, and when compared to costs for manual pruning, less expensive.

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